I-7011/11D, I-7011P/11PD, I-7018, I-7018P User Manual

Warranty

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1. Introduction

I-7000 is a family of network data acquisition and control modules. They provide analog-to-digital, digital-to-analog, digital input/output, timer/counter and other functions. These modules can be remote controlled by a set of commands. The common features of I-7011/11D/11P/11PD/18/18P are given as following :

- 3000VDC Isolated analog input
- 24-bits sigma-delta ADC to provide excellent accuracy
- Thermocouple direct connect with build-in CJC
- Software calibration

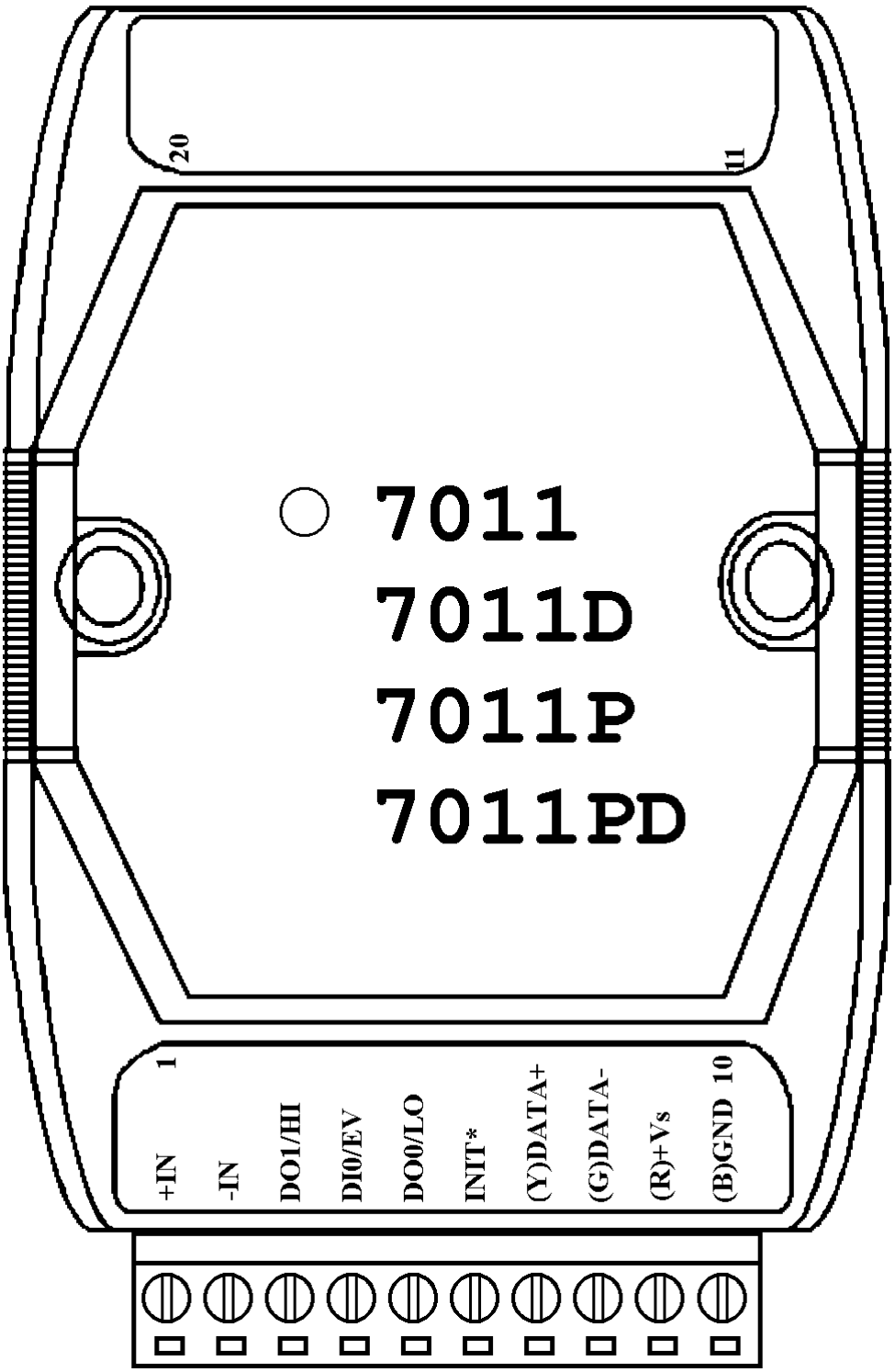
The I-7011 is a single channel analog input module. The I-7011D is the I-7011 with a 4½ digit LED display. The I-7018 is a 8-channel analog input module. The I-7011P/11PD/18P is the enhanced version of I-7011/11D/18. The I-7011P/11PD/18P support more thermocouple types and enhanced the measure range of some types.

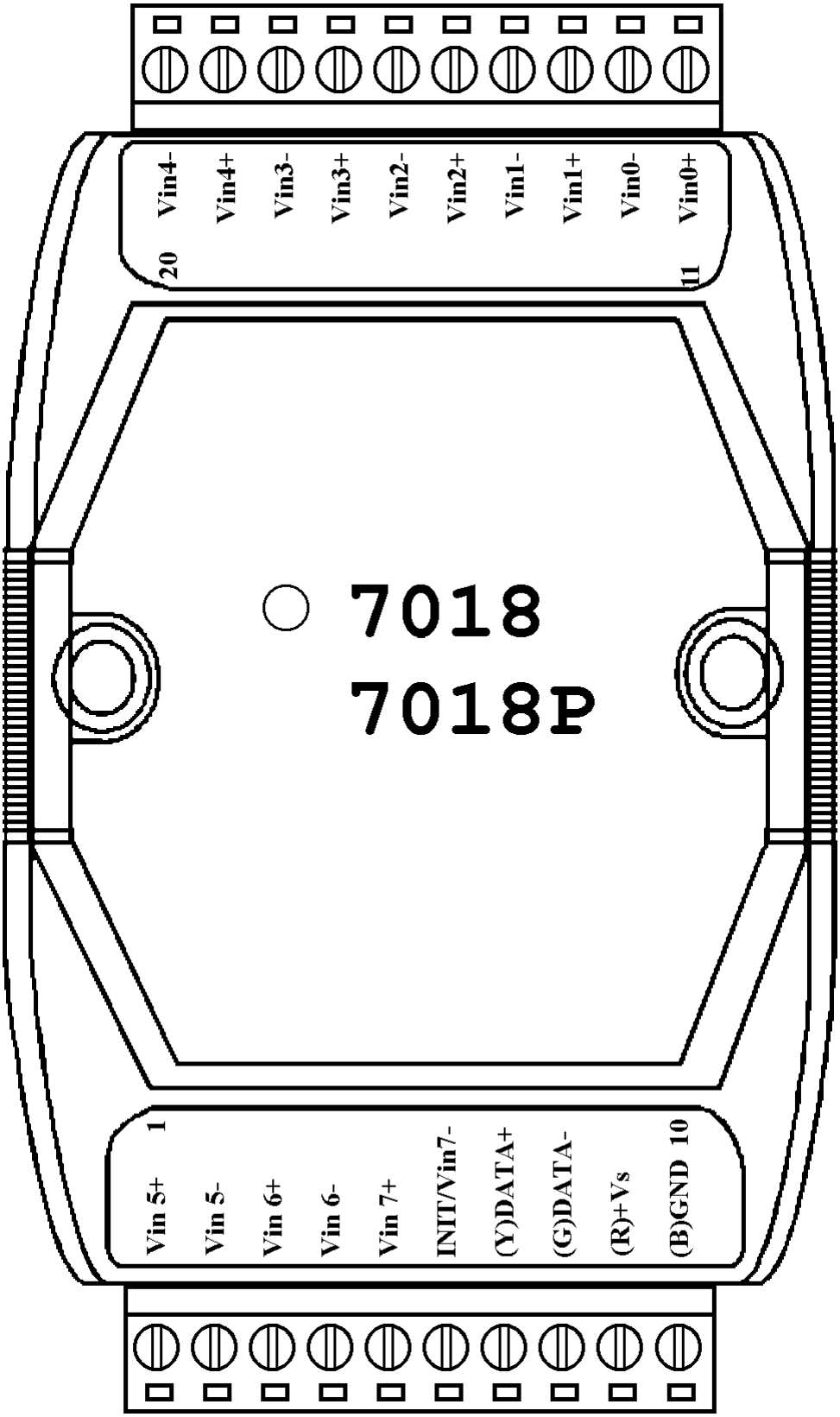
1.1 More Information

Refer to "**I-7000 Bus Converter User Manual**" chapter 1 for more information as following:

1.1 I-7000 Overview
1.2 I-7000 Related Documentation
1.3 I-7000 Command Features
1.4 I-7000 System Network Configuration
1.5 I-7000 Dimension

1.2 Pin Assignment





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1.3 Specifications

I-7011/I-7011D

Analog Input

Input Channel : 1

Input Type :

mV, V, mA(with external 125 ohms resistor)

Thermocouple : Type J, K, T, E, R, S, B, N, C

Sampling Rate :

10 Samples/Second

Bandwidth : 5.24 Hz

Accuracy : ±0.05%

Zero Drift : 0.5μV/°C

Span Drift : 25ppm/°C

CMR@50/60Hz : 150dB

NMR@50/60Hz : 100dB

Input Impedance : 20M Ohms

Isolation : 3000VDC

Digital Output

2 channel

Open Collector to 30V

Output Load : sink 30mA max

Power Dissipation : 300mW

Digital Input

1 channel

Logic Level 0 : +1V max

Logic Level 1 : +3.5 to 30V

Event Counter

Max Input Frequency : 50 Hz

Min. Pulse Width : 1 mS

Displayed LED

4½ digits (for I-7011D)

Power Supply

Input : +10 to +30 VDC

Consumption :

0.9W for I-7011

1.5W for I-7011D

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I-7011P/I-7011PD

Analog Input

Input Channel : 1

Input Type :

mV, V, mA(with external 125 ohms resistor)

Thermocouple : Type J, K, T, E, R, S, B, N, C, L, M

Sampling Rate :

10 Samples/Second

Bandwidth : 5.24 Hz

Accuracy : ±0.05%

Zero Drift : 0.5μV/°C

Span Drift : 25ppm/°C

CMR@50/60Hz : 150dB

NMR@50/60Hz : 100dB

Input Impedance : 20M Ohms

Isolation : 3000VDC

Digital Output

2 channel

Open Collector to 30V

Output Load : sink 30mA max

Power Dissipation : 300mW

Digital Input

1 channel

Logic Level 0 : +1V max

Logic Level 1 : +3.5 to 30V

Event Counter

Max Input Frequency : 50 Hz

Min. Pulse Width : 1 mS

Displayed LED

4½ digits (for I-7011PD)

Power Supply

Input : +10 to +30 VDC

Consumption :

0.9W for I-7011P

1.5W for I-7011PD

I-7018

Analog Input

Input Channel :

8 differential or 6 differential and 2 single-ended. Jumper select.

Input Type :

mV, V, mA(with external 125 ohms resistor)

Thermocouple : Type J, K, T, E, R, S, B, N, C

Sampling Rate :

10 Samples/Second

Bandwidth : 15.7 Hz

Accuracy : ±0.1%

Zero Drift : 0.5μV/°C

Span Drift : 25ppm/°C

CMR@50/60Hz : 150dB

NMR@50/60Hz : 100dB

Input Impedance : 20M Ohms

Overvoltage Protection : ±35V

Isolation : 3000VDC

Power Supply

Input : +10 to +30 VDC

Consumption : 1.0W

I-7018P

Analog Input

Input Channel :

8 differential or 6 differential and 2 single-ended. Jumper select.

Analog Input Type :

mV, V, mA(with external 125 ohms resistor)

Thermocouple : Type J, K, T, E, R, S, B, N, C, L, M

Sampling Rate :

10 Samples/Second

Bandwidth : 15.7 Hz

Accuracy : ±0.1%

Zero Drift : 0.5μV/°C

Span Drift : 25ppm/°C

CMR@50/60Hz : 150dB

NMR@50/60Hz : 100dB

Input Impedance : 20M Ohms

Overvoltage Protection : ±35V

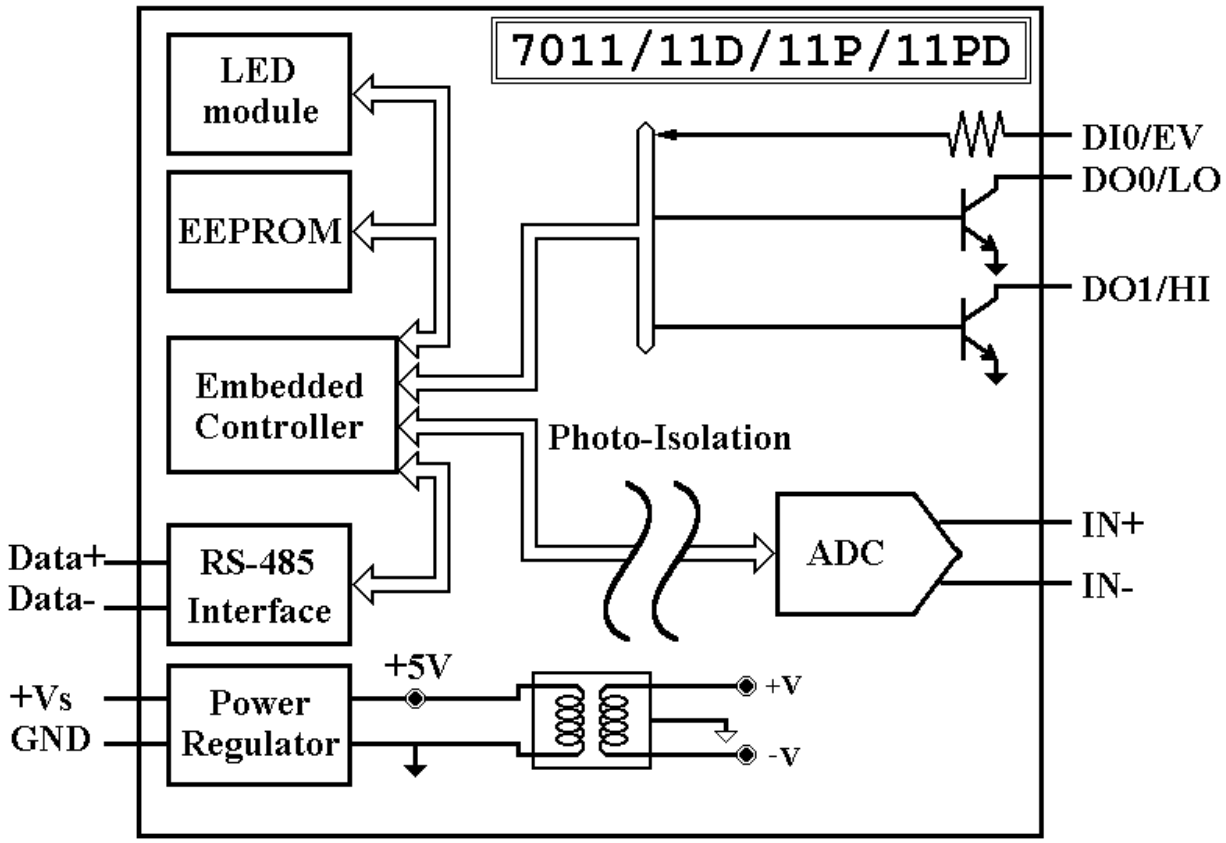
Isolation : 3000VDC

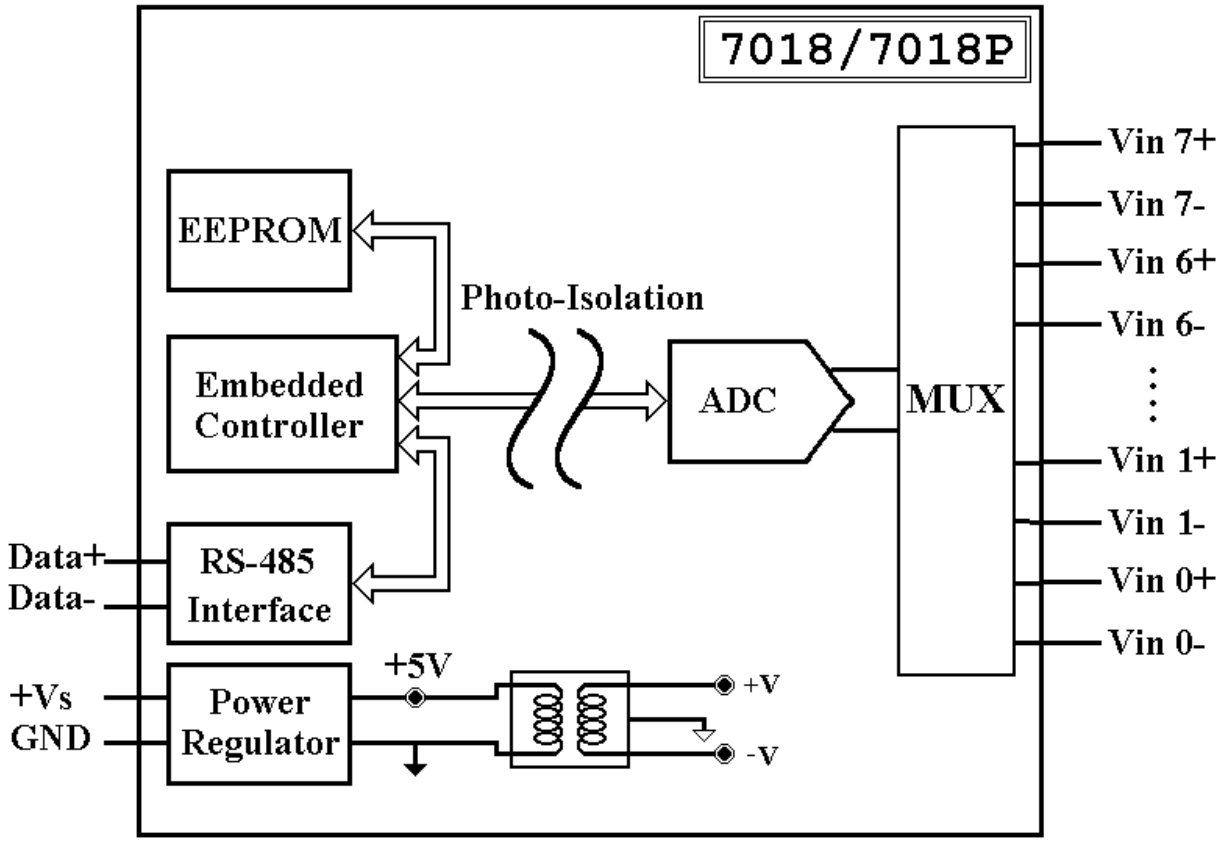
Power Supply

Input : +10 to +30 VDC

Consumption : 1.0W

1.4 Block Diagram





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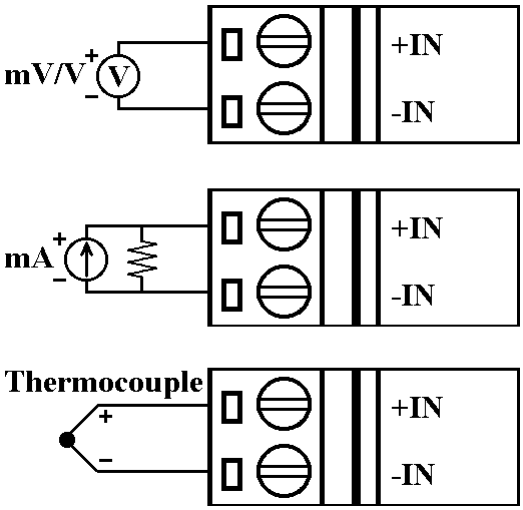
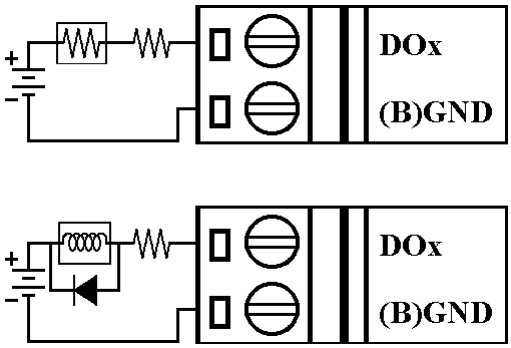
1.5 Wire Connection

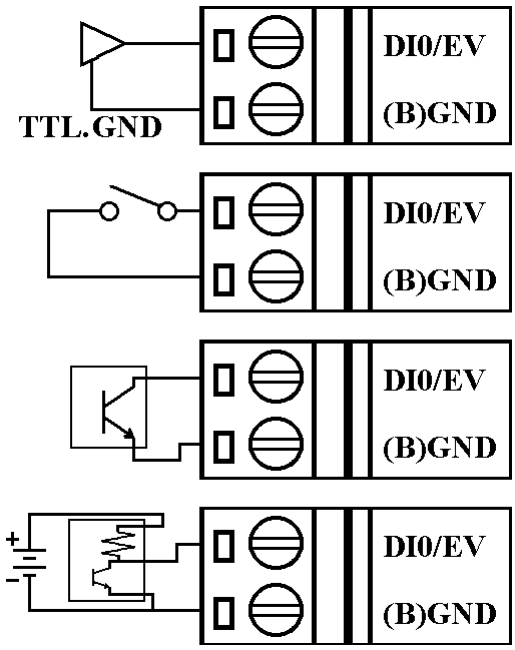
I-7011/11D/11P/11PD Analog Input Wire Connection



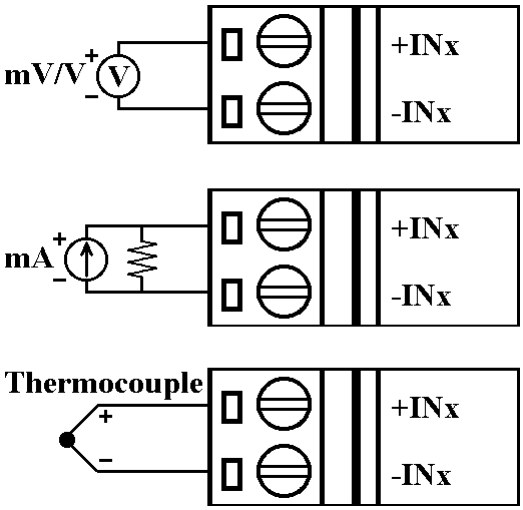
I-7011/11D/11P/11PD Digital Output Wire Connection



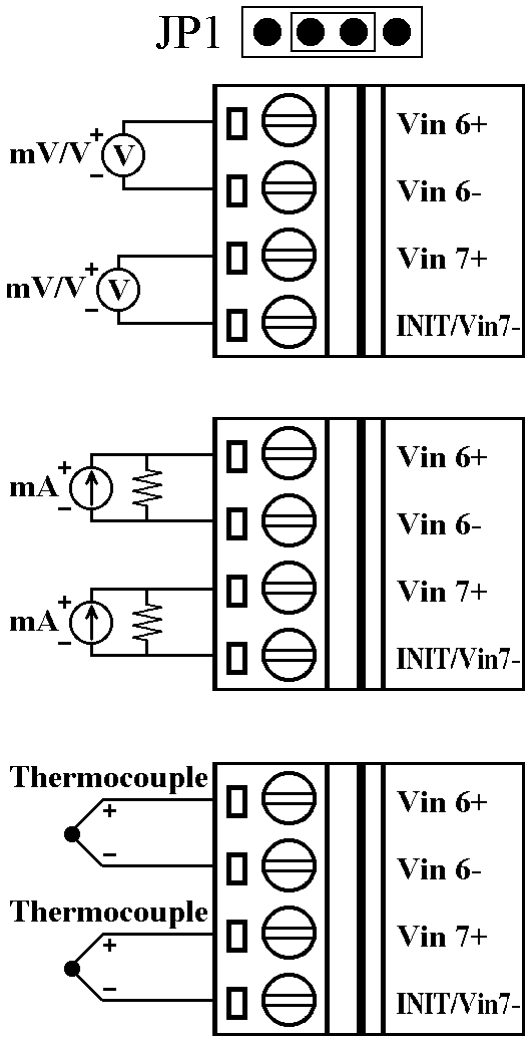
I-7011/11D/11P/11PD Digital Input Wire Connection



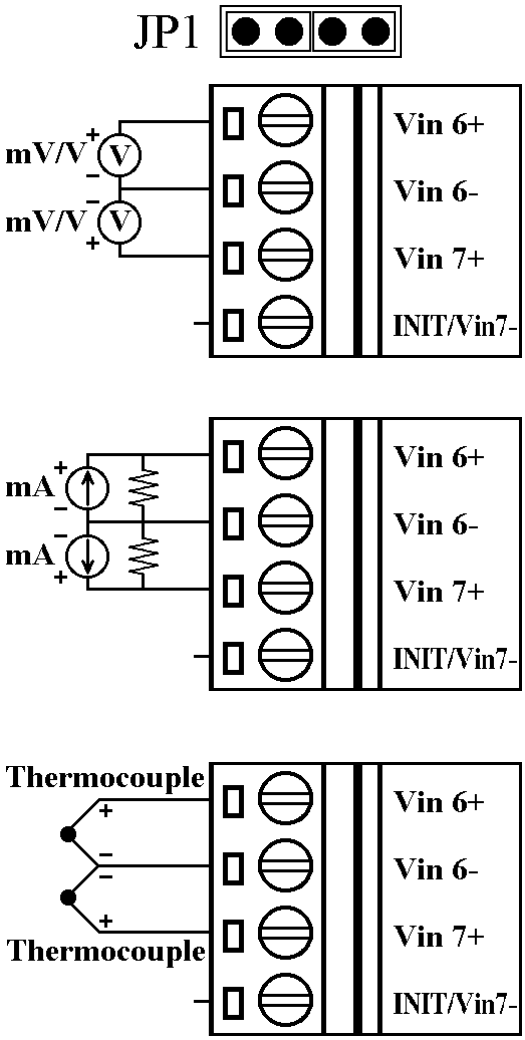
I-7018/18P Analog Input Channel 0 to 5 Wire Connection



I-7018/18P Analog Input Channel 6 and 7 Wire Connection, while the jumper JP1 setting is 8 differential mode.



I-7018/18P Analog Input Channel 6 and 7 Wire Connection, while the jumper JP1 setting is INIT* mode.



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1.6 Quick Start

Refer to "**I-7000 Bus Converter User Manual**" and "**Getting Start**" for more detail.

1.7 Default Setting

Default setting for I-7011/11D/11P/11PD/18/18P :

- Address : 01
- Analog Input Type : Type 05, -2.5 to +2.5 V
- Baudrate : 9600 bps
- Checksum disable, 60Hz rejection, engineer unit format
- I-7018/18P set as INIT* mode, and the analog input is 6 differential and 2 single-ended.

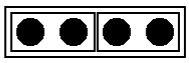
1.8 Jumper Setting

I-7018/18P : Jumper JP1 for select the pin INIT*/Vin 7-

Select 8 differential mode, the pin INIT*/Vin7- is set to Vin7-

JP1

Select INIT* mode, the pin INIT*/Vin7- is set to INIT*

JP1 

1.9 Calibration

Don't Perform Calibrate Until You Really Understand.

Calibration Requirement for I-7011/11D/11P/11PD/18/18P

Type Code	00	01	02	03	04	05	06
Min. Input	0 mV	0 mV	0 mV	0 mV	0 V	0 V	0 mA
Max Input	+15 mV	+50 mV	+100 mV	+500 mV	+1 V	+2.5 V	+20 mA

Notification :

1 While calibrate type 06, need connect external shunt resistor, 125 ohms, 0.1% (Ref *Sec.1.5*).

2 Connect calibration voltage(or current) signal to module's input. For I-7018/18P, connect to channel 0. (Wire connect ref *Sec.1.5)*

3 Before calibration, warm-up module about 30 minutes for better accuracy.

Example Calibration Sequence for Type 00 :

1 Setting Type to 00 -> Ref *Sec.2.1.*

2 Enable Calibration -> Ref *Sec.2.20.*

3 Apply Zero Calibration Voltage (0mV)

4 Preform Zero Calibration Command -> Ref *Sec.2.6.*

5 Apply Span Calibration Voltage (15mV)

6 Perform Span Calibration Command -> Ref *Sec.2.5.*

7 Repeat step1 to step6 three times.

Calibration sequence for other type is similiar but different in step 1 to set different type.

1.10 Configuration Tables

Configuration Table of I-7011/11D/11P/11PD/18/18P :

Baudrate Setting (CC)

Code	03	04	05	06	07	08	09	0A
Baudrate	1200	2400	4800	9600	19200	38400	57600	115200

Analog Input Type Setting (TT)

Type Code	00	01	02	03	04	05	06
Min. Input	-15 mV	-50 mV	-100 mV	-500 mV	-1 V	-2.5 V	-20 mA
Max Input	+15 mV	+50 mV	+100 mV	+500 mV	+1 V	+2.5 V	+20 mA

Type Code	0E	0F	10	11	12	13	14	15	16	17	18
T.C. Type	J	K	T	E	R	S	B	N	C	L	M
Min Temp.	-210	-270	-270	-270	0	0	0	-270	0	-200	-200
Max Temp.	760	1372	400	1000	1768	1768	1820	1300	2320	800	100
The temperature is shown in degree Celsius											

T.C Type L and M for I-7011P/11PD/18P only.

Data Format Setting (FF)

7	6	5	4	3	2	1	0
*1	*2	0	0	0	0	*3	

*1 :Filter Select : 0 = 60Hz rejection

1 = 50Hz rejection

*2 :Checksum Bit : 0=Disable, 1=Enable

*3 :00 = Engineer Unit Format

01 = Percent Format

10 = 2's Complement HEX Format

Analog input type and data format table

Type Code	Input Range	Data Format	+F.S.	Zero	-F.S.
00	-15 to +15 mV	Engineer Unit	+15.000	+00.000	-15.000
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000
01	-50 to +50 mV	Engineer Unit	+50.000	+00.000	-50.000
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000
02	-100 to +100 mV	Engineer Unit	+100.00	+000.00	-100.00
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000
03	-500 to +500 mV	Engineer Unit	+500.00	+000.00	-500.00
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000
04	-1 to +1 V	Engineer Unit	+1.0000	+0.0000	-1.0000
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000
05	-2.5 to +2.5 V	Engineer Unit	+2.5000	+0.0000	-2.5000
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000
06	-20 to +20 mA	Engineer Unit	+20.000	+00.000	-20.000
		% of FSR	+100.00	+000.00	-100.00
		2's complement HEX	7FFF	0000	8000

Type Code	Input Range	Data Format	+F.S.	Zero	-F.S.
0E	J Type -210 to 760 degree Celsius	Engineer Unit	+760.00	+00.000	-210.00
		% of FSR	+100.00	+000.00	-027.63
		2's complement HEX	7FFF	0000	DCA2
0F	K Type -270 to 1372 degree Celsius	Engineer Unit	+1372.0	+00.000	-0270.0
		% of FSR	+100.00	+000.00	-019.68
		2's complement HEX	7FFF	0000	E6D0
10	T Type -270 to 400 degree Celsius	Engineer Unit	+400.00	+000.00	-270.00
		% of FSR	+100.00	+000.00	-067.50
		2's complement HEX	7FFF	0000	A99A
11	E Type -270 to 1000 degree Celsius	Engineer Unit	+1000.0	+000.00	-0270.0
		% of FSR	+100.00	+000.00	-027.00
		2's complement HEX	7FFF	0000	DD71
12	R Type 0 to 1768 degree Celsius	Engineer Unit	+1768.0	+0000.0	+0000.0
		% of FSR	+100.00	+0000.0	+0000.0
		2's complement HEX	7FFF	0000	0000
13	S Type 0 to 1768 degree Celsius	Engineer Unit	+1786.0	+0.0000	+0000.0
		% of FSR	+100.00	+000.00	+0000.0
		2's complement HEX	7FFF	0000	0000
14	B Type 0 to 1820 degree Celsius	Engineer Unit	+1820.0	+00.000	+0000.0
		% of FSR	+100.00	+000.00	+0000.0
		2's complement HEX	7FFF	0000	0000
15	N Type -270 to 1300 degree Celsius	Engineer Unit	+1300.0	+00.000	-0270.0
		% of FSR	+100.00	+000.00	-20.77
		2's complement HEX	7FFF	0000	E56B

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Type Code	Input Range	Data Format	+F.S.	Zero	-F.S.
16	C Type 0 to 2320 degree Celsius	Engineer Unit	+2320.0	+00.000	+00.000
		% of FSR	+100.00	+000.00	+000.00
		2's complement HEX	7FFF	0000	0000
17*1	L Type -200 to 800 degree Celsius	Engineer Unit	+800.00	+00.000	-200.00
		% of FSR	+100.00	+000.00	-025.00
		2's complement HEX	7FFF	0000	E000
18*1	M Type -200 to 100 degree Celsius	Engineer Unit	+100.00	+000.00	-200.00
		% of FSR	+050.00	+000.00	-100.00
		2's complement HEX	4000	0000	8000
*1 : Only available for I-7011P, I-7011PD and I-7018P					

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2. Command

Command Format : **(Leading)(Address)(Command)[CHK](cr)**

Response Format : **(Leading)(Address)(Data)[CHK](cr)**

[CHK] 2-character checksum

(cr) end-of-command character, character return(0x0D)

General Command Sets			
Command	**Response**	**Description**	**Section**
%AANNTTCCFF	!AA	Set Module Configuration	***Sec.2.1***
#**	No Response	Synchronized Sampling	***Sec.2.2***
#AA	>(Data)	Read Analog Input	***Sec.2.3***
#AAN	>(Data)	Read Analog Input from channel N	***Sec.2.4***
$AA0	!AA	Perform Span Calibration	***Sec.2.5***
$AA1	!AA	Perform Zero Calibration	***Sec.2.6***
$AA2	!AATTCCFF	Read Configuration	***Sec.2.7***
$AA3	>(Data)	Read CJC Temperature	***Sec.2.8***
$AA4	>AAS(Data)	Read Synchronized Data	***Sec.2.9***
$AA5VV	!AA	Set Channel Enable	***Sec.2.10***
$AA6	!AAVV	Read Channel Status	***Sec.2.11***
$AA8	!AAV	Read LED Configuration	***Sec.2.12***
$AA8V	!AA	Set LED Configuration	***Sec.2.13***
$AA9(Data)	!AA	Set CJC Offset Value	***Sec.2.14***
$AAB	!AAS	T.C. Open Dectection	***Sec.2.15***
$AAF	!AA(Data)	Read Firmware Version	***Sec.2.16***
$AAM	!AA(Data)	Read Module Name	***Sec.2.17***
$AAZ(Data)	!AA	Send LED Data	***Sec.2.18***

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General Command Sets (Continued)			
~AAO(Data)	!AA	Set Module Name	***Sec.2.19***
~AAEV	!AA	Enable/Disable Calibration	***Sec.2.20***
Digital Input/Output, Alarm and Event Counter Command Sets			
@AADI	!AASOOII	Read Digital I/O and Alarm Status	***Sec.2.21***
@AADO(Data)	!AA	Set Digital Output	***Sec.2.22***
@AAEAT	!AA	Enable Alarm	***Sec.2.23***
@AAHI(Data)	!AA	Set High Alarm	***Sec.2.24***
@AALO(Data)	!AA	Set Low Alarm	***Sec.2.25***
@AADA	!AA	Disable Alarm	***Sec.2.26***
@AACA	!AA	Clear Latch Alarm	***Sec.2.27***
@AARH	!AA(Data)	Read High Alarm	***Sec.2.28***
@AARL	!AA(Data)	Read Low Alarm	***Sec.2.29***
@AARE	!AA(Data)	Read Event Counter	***Sec.2.30***
@AACE	!AA	Clear Event Counter	***Sec.2.31***
Host Watchdog Command Sets			
~**	No Response	Host OK	***Sec.2.32***
~AA0	!AASS	Read Module Status	***Sec.2.33***
~AA1	!AA	Reset Module Status	***Sec.2.34***
~AA2	!AAVV	Read Host Watchdog Timeout Value	***Sec.2.35***
~AA3EVV	!AA	Set Host Watchdog Timeout Value	***Sec.2.36***
~AA4	!AAPPSS	Read PowerOn Value and Safe Value	***Sec.2.37***
~AA5PPSS	!AA	Set PowerOn Value and Safe Value	***Sec.2.38***

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2.1 %AANNTTCCFF

Description : Set module Configuration

Syntax : **%AANNTTCCFF[CHK](cr)**

% a delimiter character

AA address of setting module(00 to FF)

NN new address for setting module(00 to FF)

TT new type for setting module (Ref *Sec.1.10*)

CC new baudrate for setting module (Ref *Sec.1.10*)

FF new data format for setting module (Ref *Sec.1.10*)

When changing the baudrate or checksum, it is necessary to short the pin INIT* to ground.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command. While change baudrate or checksum setting without shorting INIT* to ground, the module will return invalid command.

AA address of response module(00 to FF)

Example :

Command : %0102050600 Receive : !02

Change address from 01 to 02, return success.

Related Command :

Sec.2.7 $AA2

Related Topics :

Sec.1.10 Configuration Tables, *Sec.3.1* INIT* pin Operation

2.2 #**

Description : Synchronized Sampling

Syntax : #**[CHK](cr)

a delimiter character

** synchronized sampling command

Response : No response

Example :

Command : $014 Receive : ?01

Read synchronized sampling data, return no data valid.

Command : #** No response

Send synchronized sampling command.

Command : $014 Receive : >011+025.123

First read, get status=1, first read.

Command : $014 Receive : >010+025.123

Second read, get status=0, have readed.

Related Command :

Sec.2.9 $AA4

Note : The command is for I-7011/11D/11P/11PD only

2.3 #AA

Description : Read Analog Input

Syntax : **#AA[CHK](cr)**

delimiter character

AA address of reading module(00 to FF)

Response : Valid Command : **>(Data)[CHK](cr)**

Syntax error or communication error may get no response.

> delimiter for valid command

(Data) analog input value, reference *Sec.1.10* for its format. For I-7018/18P, the data is the combination for each channel respectively.

Example :

Command : #01 Receive : >+02.635

Read address 01, return data success.

Command : #02 Receive : >4C53

Read address 02, return data in HEX format success.

Command : #04

Receive : >+05.123+04.153+07.234-02.356+10.000-05.133+02.345+08.234

Module address 04 is I-7018. Read address 04, get analog input data of 8 channels.

Related Command :

Sec.2.1 %AANNTTCCFF, *Sec.2.7* $AA2

Related Topics :

Sec.1.10 Configuration Tables

2.4 #AAN

Description : Read Analog Input from channel N

Syntax : **#AAN[CHK](cr)**

#	delimiter character
AA	address of reading module (00 to FF)
N	channel to read, from 0 to 7

Response : Valid Command : **>(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

>	delimiter for valid command
?	delimiter for invalid command
AA	address of response module(00 to FF)
(Data)	analog input value, reference *Sec.1.10* for its format

Example :

Command : #032 Receive : >+02.513

Read address 03 channel 2, get data success.

Command : #029 Receive : ?02

Read address 02 channel 9, return error channel number.

Related Command :

Sec.2.1 %AANNTTCCFF, *Sec.2.7* $AA2

Related Topics :

Sec.1.10 Configuration Tables

Note : The command is for I-7018/18P only

2.5 $AA0

Description : Perform Span Calibration

Syntax : **$AA0[CHK](cr)**

$ delimiter character

AA address of setting module (00 to FF)

0 command for performing span calibration

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command or the calibration is not enabled

AA address of response module(00 to FF)

Example :

Command : $010 Receive : !01

Perform address 01 span calibration, return success.

Command : $020 Receive : ?02

Perform address 02 span calibration, return the calibration is not enabled before perform calibration command.

Related Command :

Sec.2.6 $AA1, *Sec.2.20* ~AAEV

Related Topics :

Sec.1.9 Calibration

2.6 $AA1

Description : Perform Zero Calibration

Syntax : **$AA1[CHK](cr)**

$ delimiter character

AA address of setting module (00 to FF)

1 command for performing zero calibration

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command or the calibration is not enabled

AA address of response module(00 to FF)

Example :

Command : $011 Receive : !01

Perform address 01 zero calibration, return success.

Command : $021 Receive : ?02

Perform address 02 zero calibration, return the calibration is not enabled before perform calibration command.

Related Command :

Sec.2.5 $AA0, *Sec.2.20* ~AAEV

Related Topics :

Sec.1.9 Calibration

2.7 $AA2

Description : Read Configuration

Syntax : **$AA2[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

2 command for reading configuration

Response : Valid Command : **!AATTCCFF[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

TT type code of module (reference *Sec.1.10*)

CC baudrate code of module (reference *Sec.1.10*)

FF data format of module (reference *Sec.1.10*)

Example :

Command : $012 Receive : !01050600

Read address 01 configuration, return success.

Command : $022 Receive : !02030602

Read address 02 configuration, return success.

Related Command :

Sec2.1 %AANNTTCCFF

Related Topics :

Sec.1.10 Configuration Tables, *Sec.3.1* INIT* pin Operation

2.8 $AA3

Description : Read CJC Temperature

Syntax : **$AA3[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

3 command for reading CJC temperature

Response : Valid Command : **>(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

> delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

(Data) CJC temperature in degree Celsius.

Example :

Command : $033 Receive : >+0025.4

Read address 03 CJC temperature, return 25.4°C.

Related Command :

Sec.2.14 $AA9(Data)

2.9 $AA4

Description : Read Synchronized Data

Syntax : **$AA4[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

4 command for reading synchronized data

Response : Valid Command : **>AAS(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command or the module does not receive command #** before the command $AA4.

AA address of response module(00 to FF)

S status of synchronized data, 1 = first time reading, 0 = has been readed

(Data) synchronized data, format reference *Sec.1.10*

Example :

See example of *Sec.2.2 #***

Related Command :

*Sec.2.2 #***

Note : The command is for I-7011/11D/11P/11PD only

2.10 $AA5VV

Description : Set Channel Enable

Syntax : **$AA5VV[CHK](cr)**

$ delimiter character

AA address of setting module (00 to FF)

5 command for settting channel enable

VV channel enable/disable, 00 is all disabled, and FF is all enabled.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : $0155A Receive : !01

Set address 01 enable channel 1,3,4,6 and disable channel 0,2, 5,7, return success.

Command : $016 Receive : !015A

Read address 01 channel status, return channel 1,3,4,6 enable and channel 0,2,5,7 disable.

Related Command :

Sec.2.11 $AA6

Note : The command is for I-7018/18P only

2.11 $AA6

Description : Read Channel Status

Syntax : **$AA6[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

6 command for reading channel status

Response : Valid Command : **!AAVV[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

VV channel enable/disable, 00 is all disabled, and FF is all enabled.

Example :

Command : $015A5 Receive : !01

Set address 01 enable channel 0,2,5,7 and disable channel 1,3, 4,6 , return success.

Command : $016 Receive : !01A5

Read address 01 channel status, return channel 0,2,5,7 enable and channel 1,3,4,6 disable.

Related Command :

Sec2.10 $AA5VV

Note : The command is for I-7018/18P only

2.12 $AA8

Description : Read LED Configuration

Syntax : **$AA8[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

8 command for setting LED configuration

Response : Valid Command : **!AAV[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

V LED configuration

1=module control, 2=host control

Example :

Command : $018 Receive : !011

Read address 01 LED configuration, return module control.

Command : $028 Receive : !012

Read address 02 LED configuration, return host control.

Related Command :

Sec2.13 $AA8V, *Sec2.18* $AAZ(Data)

Note : The command is for I-7011D/11PD only

2.13 $AA8V

Description : Set LED Configuration

Syntax : **$AA8V[CHK](cr)**

$ delimiter character

AA address of setting module (00 to FF)

8 command for setting LED configuration

V 1=Set LED to module, 2=Set LED to host

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : $0182 Receive : !01

Set address 01 LED to host control, return success.

Command : $0281 Receive : !02

Set address 02 LED to module control, return success.

Related Command :

Sec2.12 $AA8, *Sec2.18* $AAZ(Data)

Note : The command is for I-7011D/11PD only

2.14 $AA9(Data)

Description : Set CJC Offset Value

Syntax : **$AA9(Data)[CHK](cr)**

$ delimiter character

AA address of setting module (00 to FF)

9 command for setting CJC offset value

(Data) CJC offset value comprises a sign and 4 hexadecimal digits, from -1000 to +1000, each count is 0.01°C.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module (00 to FF)

Example :

Command : $019+0010 Receive : !01

Set address 01 CJC offset increase 16 counts (+0.16°C), return success.

Related Command :

Sec.2.8 $AA3

2.15 $AAB

Description : Thremocouple Open Detection

Syntax : **$AAB[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

B command for reading thremocouple open status

Response : Valid Command : **!AAS[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

S 0=close-loop detection

1=open-circuit detection, need to check the thermocouple

Example :

Command : $01B Receive : !010

Read address 01 thermocouple open status, return the thermo-couple is close-loop.

Note : The command is for I-7011/11D/11P/11PD only

2.16 $AAF

Description : Read Firmware Version

Syntax : **$AAF[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

F command for reading firmware version

Response : Valid Command : **!AA(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

(Data) firmware version of module

Example :

Command : $01F Receive : !01A2.0

Read address 01 firmware version, return version A2.0.

Command : $02F Receive : !01B1.1

Read address 02 firmware version, return version B1.1.

2.17 $AAM

Description : Read Module Name

Syntax : **$AAM[CHK](cr)**

$ delimiter character

AA address of reading module (00 to FF)

M command for reading module name

Response : Valid Command : **!AA(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

(Data) Name of module

Example :

Command : $01M Receive : !017018

Read address 01 module name, return name 7018.

Command : $03M Receive : !037011D

Read address 03 module name, return name 7011D.

Related Command :

Sec.2.19 ~AAO(Data)

2.18 $AAZ(Data)

Description : Set LED Data

Syntax : **$AAZ(Data)[CHK](cr)**

$ delimiter character

AA address of setting module (00 to FF)

Z command for setting LED data

(Data) data for show on the LED, from -19999. to +19999. The data need sign, 5 digits and decimal point.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command or LED not set to host control

AA address of response module (00 to FF)

Example :

Command : $01Z+123.45 Receive : !01

Send address 01 LED data +123.45, return success.

Command : $02Z+512.34 Receive : ?02

Send address 02 LED data +512.34, return the LED is not setting in the host mode.

Related Command :

Sec.2.12 $AA8, *Sec2.13* $AA8V

Note : The command is for I-7011D/11PD only

2.19 ~AAO(Data)

Description : Set Module Name

Syntax : **~AAO(Data)[CHK](cr)**

~ delimiter character

AA address of setting module (00 to FF)

O command for setting module name

(Data) new name for module, max 6 characters

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : ~01O7018 Receive : !01

Set address 01 module name to 7018, return success.

Command : $01M Receive : !017018

Read address 01 module name, return 7018.

Related Command :

Sec.2.17 $AAM

2.20 ~AAEV

Description : Enable/Disable Calibration

Syntax : **~AAEV[CHK](cr)**

~ delimiter character

AA address of setting module (00 to FF)

E command for enable/disable calibration

V 1=enable calibration, 0=disable calibration

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : $010 Receive : ?01

Perform address 01 span calibration, return it is not ready for calibration.

Command : ~01E1 Receive : !01

Set address 01 to enable calibration, return success.

Command : $010 Receive : !01

Preform address 01 span calibration, return success.

Related Command :

Sec.2.5 $AA0, *Sec.2.6* $AA1

Related Topic :

Sec.1.9 Calibration

2.21 @AADI

Description : Read Digital I/O and Alarm Status

Syntax : **@AADI[CHK](cr)**

@ delimiter character

AA address of reading module (00 to FF)

DI command for reading digital I/O and alarm status

Response :Valid Command : **!AASOOII[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

S alarm enable status, 0=alarm disable, 1=momentary alarm enabled, 2=latch alarm enabled.

OO digital output status, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=OD0 on, DO1 on.

II digital input status, 00=input low level, 01=input high level.

Example :

Command : @01DI Receive : !0100001

Read address 01 digital I/O status, return alarm disable, digital outputs all off, and digital input high level.

Command : @02DI Receive : !0210100

Read address 02 digital I/O status, return momentary alarm enable, high alarm is clear, low alarm is set, and digital input is high.

Related Command :

Sec.2.22 @AADO(Data), *Set.2.23* @AAEAT, *Sec.2.26* @AADA

Related Topic :

Sec.3.4 Digital Input and Event Counter, *Sec.3.5* Digital Output, *Sec.3.6* High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.22 @AADO(Data)

Description : Set Digital Output

Syntax : **@AADI[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

DO command for setting digital output

(Data) output value, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=DO0 on, DO1 on

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command. While the alarm is enabled, the command will return invalid.

AA address of response module(00 to FF)

Example :

Command : @01DO00 Receive : !01

Set address 01 digital output 00, return success.

Related Command :

Sec.2.21 @AADI, *Set.2.23* @AAEAT, *Sec.2.26* @AADA

Related Topic :

Sec.3.5 Digital Output

Note : The command is for I-7011/11D/11P/11PD only

2.23 @AAEAT

Description : Enable Alarm

Syntax : **@AAEAT[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

EA command for enable alarm.

T alarm type, M=momentary alarm, L=latch alarm.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : @01EAM Receive : ?01

Set address 01 momentary alarm, return success.

Related Command :

Sec.2.26 @AADA, *Sec.2.27* @AACA

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.24 @AAHI(Data)

Description : Set High Alarm

Syntax : **@AADI[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

HI command for setting high alarm value

(Data) high alarm values, data format is in engineer unit format.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : @01HI+2.5000 Receive : !01

Set address 01 high alarm +2.5000, return success.

Related Command :

Sec.2.23 @AAEAT, *Sec.2.28* @AARH

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.25 @AALO(Data)

Description : Set Low Alarm

Syntax : **@AADI[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

LO command for setting high alarm value

(Data) high alarm values, data format is in engineer unit format.

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : @01LO-2.5000 Receive : !01

Set address 01 low alarm -2.5000, return success.

Related Command :

Sec.2.23 @AAEAT, *Sec.2.29* @AARL

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.26 @AADA

Description : Disable Alarm

Syntax : **@AADA[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

DA command for disable alarm

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : @01DA Receive : !01

Disable address 01 alarm, return success.

Related Command :

Sec.2.23 @AAEAT

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.27 @AACA

Description : Clear Latch Alarm

Syntax : **@AACA[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

CA command for clear latch alarm

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : @01DI Receive : !0120101

Read address 01 digital input, return latch alarm mode, low alarm is set.

Command : @01CA Receive : !01

Clear address 01 latch alarm, return success.

Command : @01DI Receive : !0120001

Read address 01 digital input, return latch alarm mode, both alarms are clear.

Related Command :

Sec.2.21 @AADI, *Sec.2.23* @AAEAT, *Sec.2.26* @AADA

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.28 @AARH

Description : Read High Alarm

Syntax : **@AARH[CHK](cr)**

@ delimiter character

AA address of reading module (00 to FF)

RH command for reading high alarm

Response : Valid Command : **!AA(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command.

? delimiter for invalid command.

AA address of response module(00 to FF)

(Data) high alarm value in engineer unit format.

Example :

Command : @01RH Receive : !01+2.5000

Read address 01 high alarm, return +2.5000.

Related Command :

Sec.2.24 @AAHI(Data)

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.29 @AARL

Description : Read Low Alarm

Syntax : **@AARH[CHK](cr)**

@ delimiter character

AA address of reading module (00 to FF)

RL command for reading low alarm

Response : Valid Command : **!AA(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command.

? delimiter for invalid command.

AA address of response module(00 to FF)

(Data) low alarm value in engineer unit format.

Example :

Command : @01RL Receive : !01-2.5000

Read address 01 low alarm, return -2.5000.

Related Command :

Sec.2.25 @AALO(Data)

Related Topic :

Sec.3.6 High/Low Alarm

Note : The command is for I-7011/11D/11P/11PD only

2.30 @AARE

Description : Read Event Counter

Syntax : **@AARE[CHK](cr)**

@ delimiter character

AA address of reading module (00 to FF)

RE command for reading event counter

Response : Valid Command : **!AA(Data)[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

(Data) event counter value, from 00000 to 65535.

Example :

Command : @01RE Receive : !0101234

Read address 01 event counter, return 1234.

Related Command :

Sec.2.31 @AACE

Related Topic :

Sec.3.4 Digital Input and Event Counter

Note : The command is for I-7011/11D/11P/11PD only

2.31 @AACE

Description : Clear Event Counter

Syntax : **@AACE[CHK](cr)**

@ delimiter character

AA address of setting module (00 to FF)

CE command for clear event counter

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : @01RE Receive : !0101234

Read address 01 event counter, return 1234.

Command : @01CE Receive : !01

Clear address 01 event counter, return success.

Command : @01RE Receive : !0100000

Read address 01 event counter, return 0.

Related Command :

Sec.2.30 @AARE

Related Topic :

Sec.3.4 Digital Input and Event Counter

Note : The command is for I-7011/11D/11P/11PD only

2.32 ~**

Description : Host OK.

Host sends this command to all modules for broadcasting the information “Host OK”.

Syntax : **~**[CHK](cr)**

~ delimiter character

** command for all modules

Response : No response.

Example :

Command : ~** No response

Send Host OK to all modules

Related Command :

Sec.2.33 ~AA0, *Sec.2.34* ~AA1, *Sec.2.35* ~AA2, *Sec.2.36* ~AA3EVV, *Sec.2.37* ~AA4, *Sec.2.38* ~AA5PSS

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

2.33 ~AA0

Description : Read Module Status

Syntax : **~AA0[CHK](cr)**

~ delimiter character

AA address of reading module (00 to FF)

0 command for reading module status

Response : Valid Command : **!AASS[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

SS Module Status. The status will store into EEPROM and only may reset by the command ~AA1.

7	6	5	4	3	2	1	0
*1	Reserved				*2	Reserved	

*1 : Host watchdog status, 0=Disable, 1=Enable

*2 : Host watchdog timeout flag, 0=Clear, 1=Set

Example :

Command : ~010 Receive : !0104

Read address 02 module status, return 04, host watchdog timeout flag is set.

Related Command :

Sec.2.34 ~AA1

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

2.34 ~AA1

Description : Reset Module Status

Syntax : **~AA1[CHK](cr)**

~ delimiter character

AA address of setting module (00 to FF)

1 command for reset module status

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : ~010 Receive : !0104

Read address 01 module status, return 04, host watchdog timeout flag is set.

Command : ~011 Receive : !01

Reset address 01 module status, return success.

Command : ~010 Receive : !0100

Read address 01 module status, return 00, Module Status is clear.

Related Command :

Sec.2.32 ~**, *Sec.2.33* ~AA0

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

2.35 ~AA2

Description : Read Host Watchdog Timeout Interval

Syntax : **~AA2[CHK](cr)**

~ delimiter character

AA address of reading module (00 to FF)

2 command for reading host watchdog timeout interval

Response : Valid Command : **!AAVV[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

VV timeout interval in HEX format, each count for 0.1 second, 01=0.1 second and FF=25.5 seconds

Example :

Command : ~012 Receive : !01FF

Read address 01 host watchdog timeout interval, return FF, host watchdog timeout interval is 25.5 seconds.

Related Command :

Sec.2.32 ~**, *Sec.2.36* ~AA3EVV

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

2.36 ~AA3EVV

Description : Set Host Watchdog Timeout Interval

Syntax : **~AA3EVV[CHK](cr)**

~ delimiter character

AA address of setting module (00 to FF)

3 command for set host watchdog timeout interval

E 1=Enable/0=Disable host watchdog

VV timeout value, from 01 to FF, each for 0.1 second

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : ~013164 Receive : !01

Set address 01 enable host watchdog and timeout interval is 64 (10.0 seconds), return success.

Command : ~012 Receive : !0164

Read address 01 host watchdog timeout interval, return timeout interval is 64 (10.0 seconds).

Related Command :

Sec.2.32 ~**, *Sec.2.35* ~AA2

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

2.37 ~AA4

Description : Read PowerOn Value and Safe Value

Syntax : **~AA4[CHK](cr)**

~ delimiter character

AA address of reading module (00 to FF)

4 command for reading PowerOn Value and Safe Value

Response : Valid Command : **!AAPPSS[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

PP PowerOn Value, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=DO0 on, DO1 on

SS Safe Value, data format is same as PP

Example :

Command : ~014 Receive : !010000

Read address 01 PowerOn/Safe Value, return PowerOn Value is DO0 off, DO1 off, Safe Value is DO0 off, DO1 off.

Related Command :

Sec.2.38 ~AA5PPSS

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

Note : The command is for I-7011/11D/11P/11PD only

2.38 ~AA5PPSS

Description : Set PowerOn Value and Safe Value

Syntax : **~AA5PPSS[CHK](cr)**

~ delimiter character

AA address of setting module (00 to FF)

5 command for setting PowerOn Value and Safe Value

PP PowerOn Value, 00=DO0 off, DO1 off, 01=DO0 on, DO1 off, 02=DO0 off, DO1 on, 03=DO0 on, DO1 on

SS Safe Value, data format is same as PP

Response : Valid Command : **!AA[CHK](cr)**

Invalid Command : **?AA[CHK](cr)**

Syntax error or communication error may get no response.

! delimiter for valid command

? delimiter for invalid command

AA address of response module(00 to FF)

Example :

Command : ~0150003 Receive : !01

Set address 01 PowerOn Value is DO0 off, DO1 off, Safe Value is DO0 on, DO1 on, return success.

Related Command :

Sec.2.37 ~AA4

Related Topic :

Sec.3.2 Module Status, *Sec.3.3* Dual Watchdog Operation

Note : The command is for I-7011/11D/11P/11PD only

3. Application Note

3.1 INIT* pin Operation

Each I-7000 module has a build-in EEPROM to store configuration information such as address, type, baudrate and other information. Sometimes, user may forget the configuration of the module. Therefore, the I-7000 have a special mode named "**INIT mode**", to help user to resolve the problem. The "**INIT mode**" is setting as **Address=00, baudrate=9600bps, no checksum**

To enable INIT mode, please follow these steps:

Step1. Power off the module

Step2. Connect the INIT* pin with the GND pin.

Step3. Power on

Step4. Send command $002(cr) in 9600bps to read the configuration stored in the module's EEPROM.

Refer to "**7000 Bus Converter User Manual**" *Sec.5.1* and "**Getting Start**" for more information.

3.2 Module Status

PowerOn Reset or **Module Watchdog Reset** will let all output goto **PowerOn Value**. And the module may accept the host's command to change the output value.

Host Watchdog Timeout will let all digital output goto **Safe Value**.The host watchdog timeout flag is set, and the output command will be ignored. The module's LED will go to flash and user must reset the Module Status via command to restore normal operation.

3.3 Dual Watchdog Operation

Dual Watchdog = Module Watchdog + Host Watchdog

The Module Watchdog is a hardware reset circuit to monitor the module's operating status. While working in harsh or noisy environment, the module may be down by the external signal. The circuit may let the module to work continues and never halt.

The Host Watchdog is a software function to monitor the host's operating status. Its purpose is to prevent the network/communication from problem or host halt. While the timeout occurred, the module will turn the all output into safe state to prevent from unexpected problem of controlled target.

The I-7000 module with Dual Watchdog may let the control system more reliable and stable.

3.4 Digital Input and Event Counter

The digital input DI0 may work as event counter. The counter updates while the input changes from high level to low level. The counter is 16-bit width and useful for low speed count, frequency is lower than 50Hz.

3.5 Digital Output

When the module power on, the host watchdog timeout flag is checked first. If the status is set, the digital outputs (DO0 and DO1) of module will set to Safe Value. If the flag is clear, the digital outputs will set to PowerOn Value.

If the host watchdog timeout flag is set, the module will ignore the digital output command @AADO(Data).

3.6 High/Low Alarm

Some analog input modules, like I-7011, equip with the high/low alarm function. When the alarm function is enabled, the digital output DO0 is the low alarm indicator, DO1 is the high alarm indicator, and the digital output command for changing digital outputs DO0, DO1 is ignored. The alarm function is to compare the analog input value with given high alarm value and low alarm value. And there are two alarm types as follows :

- **Momentary alarm :** the alarm status is cleared while the analog input is not over the alarm value.

  If Analog Input Value > High Alarm, DO1(High alarm) is on, else DO1 is off.

  If Analog Input Value < Low Alarm, DO0(Low alarm) is on, else DO0 is off.

- **Latch Alarm :** the alarm is cleared only the user send command to clear.

  If Analog Input Value > High Alarm, DO1(High alarm) is on, else if Analog Input Value < Low Alarm, DO0(Low alarm) is on.

3.7 Thermocouple Measurement

When two wires composed of dissimilar metal are joined at one end and heated, the open circuit voltage is a function of the junction temperature and the composition of the two metals. All dissimilar metals exhibit this effect. The voltage is called “Seebeck voltage”. For small changes in temperature the Seebeck voltage is linearly proportional to temperature.

To measure the Seebeck voltage directly is not available because we must first connect a voltmeter to the thermocouple, and the voltmeter leads themselves create a new thermoelectric circuit. Therefore we need to eliminate the junction thermoelectric to measure the correct Seebeck voltage, and this is called “Cold Junction Compensation”.

For most thermocouples, the Seebeck voltage is 0V while in 0°C. One simple way to cancel the junction voltage is to put the junction into 0°C enviroment and the junction voltage is 0V. Normally, this is not a good method for most application. Typical method is to measure the junction temperature by thermistor, and measure the junction voltage from the junction temperature. Then we may get the Seebeck voltage from measured thermocouple voltage and junction voltage, and we may calculate the temperature from the Seebeck voltage.